

wherein:

- (d) said multi-lumen main body portion comprises:
 - (i) at least one lumen for holding and supporting fiber optic filaments;
 - (ii) at least one lumen for receiving thermal element connectors;
 - (iii) at least one lumen for receiving a device for temperature measurement;
 - (iv) at least one lumen associated with a balloon mounted at the distal end of said multi-lumen main body portion for assisting in placement of said multi-lumen main body portion in a patient;
 - (v) a port defined by surfaces of one of the lumens of said multi-lumen main body portion, said port for injecting a fluid into a blood stream of a patient;
 - (vi) a fiber optic apparatus including said fiber optic filaments, said fiber optic filaments disposed in said at least one lumen for holding and supporting said fiber optic filaments, and said fiber optic filaments extending from inside said multi-lumen main body portion to a fiber optic coupler associated with the catheter; and
 - (vii) a necked-down portion near the distal end of said multi-lumen main body portion;

(e) a temperature measurement apparatus is mounted at the distal end of said multi-lumen main body portion;

(f) wiring extends from the temperature measurement apparatus along said multi-lumen main body portion to a housing associated with said multi-lumen main body portion;

(g) an external thermal element is mounted on said multi-lumen main body portion near the distal end of said multi-lumen main body portion; and

(h) connectors extend from said external thermal element along said multi-lumen main body portion for connection to a thermal element housing at the proximal end of said multi-lumen main body portion,

wherein:

(i) said external thermal element and said temperature measurement apparatus are operative with an external apparatus for providing a measurement of continuous cardiac output of a patient;

(j) said fiber optic apparatus is cooperative with said external apparatus for providing a measurement of mixed venous oxygen saturation of blood of the patient; and

(k) said external thermal element is mounted on said necked-down portion.

46. (Not Further Amended) A multi-lumen, multi-purpose cardiac catheter comprising:

(a) a multi-lumen main body portion;

(b) a plurality of extension tubes, each one of said plurality of extension tubes being connected to a respective lumen of said multi-lumen main body portion; and

(c) an interface connecting said multi-lumen main body portion and said plurality of extension tubes, wherein:

(d) said multi-lumen main body portion comprises:

- (i) at least one lumen for holding and supporting fiber optic filaments;
- (ii) at least one lumen for receiving thermal element connectors;
- (iii) at least one lumen for receiving a device for temperature measurement;
- (iv) at least one lumen associated with a balloon mounted at the distal end of said multi-lumen main body portion for assisting in placement of said multi-lumen main body portion in a patient;
- (v) a fiber optic apparatus including said fiber optic filaments, said fiber optic filaments in said at least one lumen for holding and supporting said fiber optic filaments, and said fiber optic filaments extending from inside said multi-lumen main body portion to a fiber optic coupler associated with the catheter; and
- (vi) a necked-down portion near the distal end of said multi-lumen main body portion;

(e) a temperature measurement apparatus is mounted at the distal end of said multi-lumen main body portion;

(f) wiring extends from the temperature measurement apparatus along said multi-lumen main body portion to a housing associated with said multi-lumen main body portion;

(g) an external thermal element is mounted on said multi-lumen main body portion near the distal end of said multi-lumen main body portion;

(h) connectors extend from said external thermal element along said multi-lumen main body portion for connection to a thermal element housing at the proximal end of said multi-lumen main body portion;

(i) said external thermal element and said temperature measurement apparatus are operative with an external apparatus for providing a measurement of continuous cardiac output of a patient;

(j) said fiber optic apparatus is cooperative with said external apparatus for providing a measurement of mixed venous oxygen saturation of blood of the patient; and

(k) said external thermal element is mounted on said necked-down portion.

47. (Not Further Amended) The multi-lumen, multi-purpose cardiac catheter of claim 46, wherein said necked-down portion is approximately 14-15 centimeters from the distal end of said multi-lumen main body portion.

48. (Not Further Amended) The multi-lumen, multi-purpose cardiac catheter of claim 46 wherein said external thermal element comprises a heater coil wound about said necked-down portion.

49. (Not Further Amended) The multi-lumen, multi-purpose cardiac catheter of claim 48, wherein said temperature measurement apparatus comprises a thermistor which is distal said heater coil.

50. (Not Further Amended) The multi-lumen, multi-purpose cardiac catheter of claim 48, wherein said heater coil comprises windings pitched at a center-to-center spacing sufficient to separate adjacent coils from one another.

51. (Not Amended) The multi-lumen, multi-purpose cardiac catheter of claim 48, wherein said heater coil is surrounded by a thin outer sheath to prevent said external thermal element from directly contacting the patient's blood.

52. (Not Further Amended) The multi-lumen, multi-purpose cardiac catheter of claim 51, wherein an outer sheath diameter of said thin outer sheath approximates an outer main body portion diameter of said multi-lumen main body portion, thereby facilitating a smooth insertion of said multi-lumen main body portion into the body of the patient.

53. (Not Further Amended) The multi-lumen, multi-purpose cardiac catheter of claim 45, wherein:

(a) said port is distal said interface and

(b) said lumen having the surfaces defining said port is an injectate lumen and said injectate lumen and said port enable injection of an injectate fluid into the blood stream of the patient.

54. (Not Further Amended) The multi-lumen, multi-purpose cardiac catheter of claim 45, wherein said external thermal element comprises a thin film member spirally wound

about said multi-lumen main body portion at approximately fourteen centimeters from the distal end of said multi-lumen main body portion.

55. (Twice Amended) The multi-lumen, multi-purpose cardiac catheter of claim 45, wherein:

81 (a) said external thermal element comprises a heating filament printed on [two opposing sides of] a substrate and

(b) said substrate is a thin material that is capable of being incorporated into a filament material that is flexible and has the ability to bond with an adhesive.

56. (Not Further Amended) The multi-lumen, multi-purpose cardiac catheter of claim 45, wherein said external thermal element comprises a layer of material with high thermal conductivity for providing temperature uniformity on a surface of said external thermal element.

57. (Not Further Amended) A multi-lumen, multi-purpose cardiac catheter comprising:

(a) a multi-lumen main body portion;

(b) a plurality of extension tubes, each one of said plurality of extension tubes being connected to a respective lumen of said multi-lumen main body portion; and

(c) an interface connecting said multi-lumen main body portion and said plurality of extension tubes,

wherein:

(d) said multi-lumen main body portion comprises:

(i) at least one lumen for holding and supporting fiber optic filaments;

- (ii) at least one lumen for receiving thermal element connectors;
- (iii) at least one lumen for receiving a device for temperature measurement;
- (iv) at least one lumen associated with a balloon mounted at the distal end of said multi-lumen main body portion for assisting in placement of said multi-lumen main body portion in a patient;
- (v) a first port defined by surfaces of one of the lumens of said multi-lumen main body portion, said first port for injecting a fluid into a blood stream of a patient;
- (vi) a fiber optic apparatus including said fiber optic filaments, said fiber optic filaments disposed in said at least one lumen for holding and supporting said fiber optic filaments, and said fiber optic filaments extending from inside said multi-lumen main body portion to a fiber optic coupler associated with the catheter; and
- (vii) a second port defined by surfaces of one of the lumens of said multi-lumen main body portion, said second port being adapted for injecting a fluid into a blood stream of the patient;

(e) a temperature measurement apparatus is mounted at the distal end of said multi-lumen main body portion;

(f) wiring extends from the temperature measurement apparatus along said multi-lumen main body portion to a housing associated with said multi-lumen main body portion;

(g) a necked-down portion of said multi-lumen main body portion is near the distal end of said multi-lumen main body portion;

(h) an external thermal element is mounted on said necked-down portion;

(i) connectors extend from said external thermal element along said multi-lumen main body portion for connection to a thermal element housing at the proximal end of said multi-lumen main body portion;

(j) said external thermal element and said temperature measurement apparatus are operative with an external apparatus for providing a measurement of continuous cardiac output of a patient; and

(k) said fiber optic apparatus is cooperative with said external apparatus for providing a measurement of mixed venous oxygen saturation of blood of the patient.

58. (Not Further Amended) A multi-lumen, multi-purpose cardiac catheter comprising:

(a) a multi-lumen main body portion;

(b) a plurality of extension tubes, each one of said plurality of extension tubes being connected to a respective lumen of said multi-lumen main body portion; and

(c) an interface connecting said main body portion and said plurality of extension tubes,

wherein:

(d) said multi-lumen main body portion comprises:

- (i) at least one lumen for holding and supporting fiber optic filaments;
- (ii) at least one lumen for receiving thermal element connectors;
- (iii) at least one lumen for receiving a device for temperature measurement;
- (iv) at least one lumen associated with a balloon mounted at the distal end of said multi-lumen main body portion for assisting in placement of said multi-lumen main body portion in a patient; and
- (v) a fiber optic apparatus including said fiber optic filaments, said fiber optic filaments in said at least one lumen for holding and supporting said fiber optic filaments, and said fiber optic filaments extending from inside said multi-lumen main body portion to a fiber optic coupler associated with the catheter;

(e) a temperature measurement apparatus is mounted at the distal end of said multi-lumen main body portion;

(f) wiring extends from the temperature measurement apparatus along said multi-lumen main body portion to a housing associated with said multi-lumen main body portion;

(g) a necked-down portion of said multi-lumen main body portion is near the distal end of said multi-lumen main body portion;

(h) an external thermal element is mounted on said necked-down portion;

(i) connectors extend from said external thermal element along said multi-lumen main body portion for connection to a thermal element housing at the proximal end of said multi-lumen main body portion;

(j) at least one lumen of said multi-lumen main body portion comprises an injectate lumen;

(k) said external thermal element and said temperature measurement apparatus are operative with an external apparatus for providing a measurement of continuous cardiac output of a patient;

(l) said fiber optic apparatus is cooperative with said external apparatus for providing a measurement of mixed venous oxygen saturation of blood of the patient; and

(m) said injectate lumen has surfaces defining a port, said port being positioned along said multi-lumen main body portion such that, when the distal tip of said main body portion is in a pulmonary artery of a patient, said port is in the right ventricle of the heart of the patient.

59. (Not Further Amended) The multi-lumen, multi-purpose cardiac catheter of claim 47, wherein said multi-lumen main body portion further comprises at least one injectate lumen for injecting a fluid into the blood stream of the patient, said injectate lumen having surfaces defining a port.

60. (Not Amended) The multi-lumen, multi-purpose cardiac catheter of claim 59, wherein

(a) said port is distal said interface and

(b) said injectate lumen and said port enable injection of an injectate fluid into the blood stream of the patient.

61. (Not Further Amended) A multi-lumen, multi-purpose cardiac catheter comprising:

(a) a multi-lumen main body portion;

(b) a plurality of extension tubes, each one of said plurality of extension tubes being connected to a respective lumen of said multi-lumen main body portion; and

(c) an interface connecting said multi-lumen main body portion and said plurality of extension tubes,

wherein:

(d) said multi-lumen main body portion comprises:

(i) at least one lumen for holding and supporting fiber optic filaments;

(ii) at least one lumen for receiving thermal element connectors and associated with a balloon mounted at the distal end of said multi-lumen main body portion;

(iii) at least one lumen for receiving a device for temperature measurement;

(iv) at least one lumen dedicated to measuring distal catheter pressure;

(v) a fiber optic apparatus including said fiber optic filaments, said fiber optic filaments disposed in said at least one lumen for holding and supporting said fiber optic filaments, and said fiber optic filaments extending from inside said multi-lumen main

body portion to a fiber optic coupler
associated with the catheter;

(e) a temperature measurement apparatus is mounted at
the distal end of said multi-lumen main body portion;

(f) wiring extends from the temperature measurement
apparatus along said multi-lumen main body portion to a
housing associated with said multi-lumen main body portion;

(g) an external thermal element is mounted on said
multi-lumen main body portion near the distal end of said
multi-lumen main body portion;

(h) connectors extend from said external thermal element
along said multi-lumen main body portion for connection to a
thermal element housing at the proximal end of said multi-
lumen main body portion;

(i) said external thermal element and said temperature
measurement apparatus are operative with an external apparatus
for providing a measurement of continuous cardiac output of a
patient;

(j) said fiber optic apparatus is cooperative with said
external apparatus for providing a measurement of mixed venous
oxygen saturation of blood of the patient; and

(k) said wiring and said fiber optic filaments are
disposed in different lumens.

62. (Not Amended) The multi-lumen, multi-purpose
cardiac catheter of claim 61, wherein said at least one lumen
dedicated to measuring distal catheter pressure comprises
surfaces defining a port.

63. (Not Amended) The multi-lumen, multi-purpose cardiac catheter of claim 62, wherein said port is for measuring distal catheter pressure.

64. (Not Amended) A multi-lumen, multi-purpose cardiac catheter comprising:

- (a) a multi-lumen main body portion;
- (b) a plurality of extension tubes, each one of said plurality of extension tubes being connected to a respective lumen of said multi-lumen main body portion; and
- (c) an interference connecting said main body portion and said plurality of extension tubes,
wherein,
- (d) said multi-lumen main body portion comprises:
 - (i) at least one lumen for holding and supporting fiber optic filaments;
 - (ii) at least one lumen for receiving thermal element connectors;
 - (iii) at least one lumen for receiving a device for temperature measurement;
 - (iv) at least one lumen associated with a balloon mounted at the distal end of said multi-lumen main body portion for assisting in placement of said multi-lumen main body portion in a patient; and
 - (v) a fiber optic apparatus including said fiber optic filaments, said fiber optic filaments in said at least one lumen for holding and supporting said fiber optic filaments, and

said fiber optic filaments extending from inside said multi-lumen main body portion to a fiber optic coupler associated with the catheter;

(e) a temperature measurement apparatus is mounted at the distal end of said multi-lumen main body portion;

(f) wiring extends from the temperature measurement apparatus along said multi-lumen main body portion;

(g) a necked-down portion of said multi-lumen main body portion is near the distal end of said multi-lumen main body portion;

(h) an external thermal element is mounted on said necked-down portion;

(i) connectors extend from said external thermal element along said multi-lumen main body portion for connection to a thermal element housing at the proximal end of said multi-lumen main body portion;

(j) at least one lumen of said multi-lumen main body portion comprises an injectate lumen;

(k) said external thermal element and said temperature measurement apparatus are operative with an external apparatus for providing a measurement of continuous cardiac output of a patient;

(l) said fiber optic apparatus is cooperative with said external apparatus for providing a measurement of mixed venous oxygen saturation of blood of the patient; and

(m) said injectate lumen has surfaces defining a port, said port being positioned along said multi-lumen main body

portion such that, when the distal tip of said main body portion is in a pulmonary artery of a patient, said port is in the right atrium or the superior vena cava of the heart of the patient.--

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